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THE ANIMAL-BREEDING INDUSTRY

By Dr. RAYMOND PEARL

THE MAINE AGRICULTURAL EXPERIMENT STATION

ANIMAL-BREEDING as an industry lies at the foundation of animal husbandry, which in turn is a basic element of the art of agriculture. Before any of the domestic animals can be used to provide food or clothing for mankind, the animals themselves must be produced. It is the function of the art or craft of animal-breeding to *produce* the world's supply of domestic animals of all kinds.

An attribute of living organisms, which fundamentally differentiates them from non-living matter, is the faculty of self-reproduction. Certain cells of the body in all higher animals are able, under suitable conditions, to go through a process of development which has as its end result the production of a new individual of the race or species. Through these cells (known as reproductive cells, or gametes) the animal has the power of reproducing itself. A new and distinct individual existence is brought into the world. Nothing like this is known in the inorganic realm. The stone in the field is not capable, through any self-initiated or self-perpetuated activity, of causing the coming into existence of a new stone, essentially like itself in form, size, structure, chemical composition and every other quality. Only plants and animals—in other words, living things—can do this.

It is this fundamental attribute of self-reproduction which the art of animal-breeding makes use of for the benefit of mankind. The breeder attempts to direct and control the reproduction of certain species and varieties of animals which possess qualities that are of value. Thus the breeder of dairy cattle endeavors so to control and direct the reproduction of these animals that he shall be able to produce cows which will yield a large amount of milk. The beef-cattle breeder tries to produce animals which carry on their frames a large amount of meat of good edible quality. The sheep-breeder has for his object to bring about the plentiful reproduction of animals bearing a large amount of wool. And so on, always the breeder is trying to control, guide and direct a fundamental biological process (reproduction) in such way that the product may be most valuable to him in some direction, either utilitarian, æsthetic or other. The more complete this control is, and the more definitely it is directed towards a particular desired end, the greater is the success of the breeder.

Man's needs or fancies have led to the production of many and diverse breeds of the domestic animals. In every civilized country special breeds and sub-breeds or varieties have been developed to meet the particular conditions prevailing there. In the number of such specialized and diversified races of animals, all of which must have come originally from a very small number of unspecialized ancestral forms, is perhaps to be found the most striking measure of the degree to which man has developed and extended his control over the natural processes of reproduction. Some idea of the extent to which this differentiation and specialization of animals for particular ends has been carried may be gained from Table I. This table shows the number of different breeds and varieties of farm live stock which are found in the British Isles.[1] Some are local varieties, but still distinct. All these are essentially native British breeds. Other countries, especially the older ones, show in greater or less degree the same conditions. They have developed breeds of live stock to suit their own special needs and fancies.

TABLE I

SHOWING THE NUMBERS OF DIFFERENT BREEDS OF BRITISH LIVE STOCK

Kind of Stock	Number of Distinct British Breeds and Varieties
Horses	17
Beef cattle	13
Dairy cattle	7[2]
Sheep	34
Swine	8

It is evident from this table that the skill of the English breeder has well justified the reputation it has created for the British Isles as one of the chief sources of the pure-bred live stock of the world.

To produce the world's supply of domestic animals, which we have seen to be the business of the animal breeder, is a task of great magnitude. Resort must be had to statistics[3] if any just conception is to be formed of the extent and importance of this breeding industry. We shall confine our attention to the United States, remembering that except in certain rather restricted lines, the animal-breeding industry in this country has as yet had no special or intensive development.

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[1] This table is compiled from "British Breeds of Live Stock," London (Board of Agriculture and Fisheries), 1910.

[2] Counting the Dairy Shorthorn as a distinct variety.

[3] The raw data on which the following statistical discussion is based are taken from the official returns of the U. S. Department of Agriculture, as published in the Yearbooks. The writer is, of course, responsible for the treatment of these figures here developed and for the deductions made.

The fact that the statistics here used are three years old in no wise invalidates the conclusions. Essentially the same conclusions would be reached from a survey of the stock-breeding industry in any normal year. Of course just at the present time industrial conditions of all sorts, including stock-breeding, are upset by war conditions. On that account, indeed, it is altogether probable that the facts as here presented give a much more nearly *normal* picture of the industry than would statistics for the years 1914 or 1915.

The following table shows the number of living domestic animals of various kinds which were on farms in the United States on January 1, 1912, together with their estimated farm value. The figures take no account of the vast numbers of horses, for example, which are not on farms.

TABLE II

NUMBER AND VALUE OF FARM LIVE STOCK IN THE UNITED STATES ON JANUARY 1, 1912

Kind of Stock	Number	Value
Horses	20,509,000	$2,172,694,000
Mules	4,362,000	544,359,000
Milch cattle	20,699,000	815,414,000
Other cattle (chiefly beef)	37,260,000	790,064,000
Sheep	52,362,000	181,170,000
Swine	65,412,000	523,328,000
Total	200,602,000	$5,027,029,000

Each one of these two hundred million animals was produced by a definite breeding operation. Somewhere somebody, with more or less care and thought as to the result, mated together two animals to produce each one of the individuals or litters which lumped together give this enormous total. The mere statement of such large figures conveys little impression to the mind. Let us try by comparison to see what the figures really mean. If all the live stock on farms in the United States on January 1, 1912, had been sold at a price such as to realize the estimated farm value in cash, and then the money so obtained had been equally divided, each individual man, woman and child in the country would have received as his share from this transaction $54.66. Furthermore the farm value of live stock represented an amount sufficient to pay the whole principal of the public debt of the United States (equal to $2,906,750,548.66 on October 1, 1913) nearly twice over.

This same sum of money would support the common schools of the United States for more than 12 years, assuming the same rate of school expenses as obtained in 1908–09. The mules or the swine each alone, if converted into cash, would pay all the common school expenses for more than a year, the cattle for four years, and the horses more than five years. The sheep of the country on January 1, 1912, were worth more than one and a half times as much as the entire property (lands, buildings, equipment, etc.) of all the colleges of agriculture and mechanic arts in the United States in 1910, the last year for which figures were available when this was written.

The figures given do not tell the whole story of the magnitude of the animal-breeding industry of the country. They deal only with the live stock actually on the farm. Besides this are the exports to be reckoned with. Table III. gives the facts regarding exports.

TABLE III

NUMBER AND VALUE OF LIVE STOCK EXPORTED FROM THE UNITED STATES DURING THE YEAR ENDING JUNE 30, 1911

Kind of Stock	Number	Value
Horses	25,145	$ 3,845,253
Mules	6,585	1,070,051
Cattle	150,100	13,163,920
Sheep	121,491	636,272
Swine	8,551	74,032
Total	311,872	$18,789,528

Over against the exports are to be set the imports. Animals are imported into the United States for purposes falling into two general classes. On the one hand, are the imports, mainly from European countries, of superior animals to be used as breeding stock. The ultimate object of such importation is the improvement of the live-stock of the country. On the other hand, there are some importations of animals for purposes of slaughter and utilization in other ways than breeding. The live-stock imports of each of these classes for the fiscal year 1910–11 are given in Table IV.

TABLE IV

NUMBER AND VALUE OF LIVE STOCK IMPORTED INTO THE UNITED STATES DURING THE YEAR ENDING JUNE 30, 1911

Kind of Stock	Why Imported	Number	Value
Horses	For breeding purposes	6,331	$2,055,418
"	" other "	3,262	636,656
Cattle	" breeding "	2,441	362,220
"	" other "	180,482	2,590,857
Sheep	" breeding "	5,341	116,277
"	" other "	48,114	261,348
Total	....	245,971	$6,022,776

From the figures given in the preceding tables it is possible to make some calculations to show average individual values. These are of interest because they furnish some indications of the cash value which rewards attention and care devoted to the breeding of animals. Let us first consider the average values of the different kinds of live stock on the farm. These figures will furnish a base with which comparison may be made. They measure in a crude way, but still a real one, the stage of development or progress which the live stock breeding industry of the country has attained. Table V. gives the figures, calculated from the data given in Table II. above.

TABLE V

AVERAGE VALUES OF LIVE STOCK ON THE FARM

Kind of Stock	Average Value of the Individual
Horses	$105.94
Mules	124.80
Milch cows	39.39
Other cattle	21.20
Sheep	3.47
Swine	8.00

It is to be expected that animals chosen for export will be on the average of somewhat better quality than those left on the farm. A part go out of the country for breeding purposes, and these will have a powerful effect in raising the average value of exported stock. In accordance with expectation, the average values for exported stock are seen in Table VI. to be in every case somewhat greater than those for farm stock. The relative amount of this increase, shown as the percentage which the difference in values is of the farm value, is given for each class of stock in a third column of the table.

TABLE VI

AVERAGE VALUES OF LIVE STOCK EXPORTED

Kind of Stock	Average Value of Individual	Percentage Increase in Average Value of Exported Over Farm Live Stock
Horses	$152.92	44.3
Mules	162.50	30.2
Cattle	37.70	216.7[4]
Sheep	5.24	51.4
Swine	8.66	8.2

While the relative increases of value seen here are respectable, considered by themselves, they are insignificant in comparison with those exhibited in the valuation of animals *imported* for breeding purposes. The figures for the latter are shown in Table VII., which is calculated in the same way as Table VI.

TABLE VII

AVERAGE VALUES OF LIVE STOCK IMPORTED FOR BREEDING PURPOSES

Kind of Stock	Average Value of Individual	Percentage Increase in Average Value of Imported Over Farm Live Stock
Horses	$324.66	206.5
Cattle	148.39	435.8
Sheep	21.77	529.2

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[4] Calculated on the basis of weighted mean of the two classes of cattle distinguished in Table V.

Taking these figures at their face value, for the moment, they indicate that the average horse imported into the United States for breeding purposes is worth twice as much as the average horse on an American farm. The average cow or bull imported is worth four and a third times as much as the average cow or bull on the farm; while the average imported sheep is more than five and a quarter times as valuable as the home product on the farm.

These figures furnish an impressive object lesson as to the value of paying attention to the breeding of live stock. Fundamentally the enhanced valuation of the imported animals rests on the fact that they are better bred than the average farm stock here. Their qualities all approach the ideal more closely. But they have been brought to that condition by the practise of skilful, well-planned and carefully executed breeding.

The statistical data so far presented regarding the breeding industry have been drawn from official returns and cover the country as a whole. They suffer from the defects of such statistics. While they show the general relations in a substantially correct way, they tend to reduce to a minimum differences of all kinds. In the case of the last comparison made, the indicated difference in average valuation between farm and live stock and that imported for breeding purposes is probably distinctly less than the true difference. A better comparison, and one which not only shows what careful breeding means to the farmer and to the nation as a source of wealth, but also shows that the foreigner has no monopoly on the production of fine breeding stock, is between average farm values and the prices realized at auction dispersal sales of pedigreed stock in this country. Let us examine a few figures of this kind.

Table VIII[5] gives the average sale price of pedigreed beef cattle in all sales held in this country during the six years preceding 1913.

The increase of these prices over the $21.00 of the farm cattle is obvious. The same considerations apply to other kinds of stock. At a Guernsey cattle sale held in Oconomowoc, Wisconsin, March 20, 1912, 69 head were sold at an average price of $377.26. Mr. H. E. Browning of Hersman, Ill., sold 41 Duroc-Jersey swine "of his own breeding" on December 19, 1912, at an average price of $173 per head. The contrast of this price with the $8.00 average on the farm is sufficiently striking.

The live-stock breeding industry of the world rests on a foundation of pure-bred pedigreed stock. The constant aim of the breeder from the earliest time has been to produce differentiated types particularly adapted to his locality, conditions and needs. Having once found or developed such a type, the breeder wishes to keep it. This he can only

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[5] Compiled by the *Breeders' Gazette* and published in the issue of January 1, 1913.

TABLE VIII

AVERAGE PRICES REALIZED AT AUCTION SALES OF PEDIGREED BEEF CATTLE

Name of Breed	1912			1911			1910		
	No. of Sales	No. Sold	Av. Price	No. of Sales	No. Sold	Av. Price	No. of Sales	No. Sold	Av. Price
Short-horn	45	1,882	$177.40	53	2,258	$162.50	49	1,999	$187.50
Hereford	15	957	180.40	19	1,203	160.50	20	1,214	146.20
Aberdeen-Angus	12	627	138.95	13	723	143.60	19	995	167.35
Galloway	[6]...	...	......	[6]...	...	......	1	67	83.30
Polled Durham	2	83	132.85	1	42	140.60	3	74	115.00
Red Poll	1	30	107.25	[6]...	...	......	1	41	185.00

Name of Breed	1909			1908			1907		
	No. of Sales	No. Sold	Av. Price	No. of Sales	No. Sold	Av. Price	No. of Sales	No. Sold	Av. Price
Short-horn	78	3,308	$159.00	59	2,689	$146.50	84	3,608	$160.15
Hereford	25	1,398	127.05	15	936	116.15	29	1,358	123.70
Aberdeen-Angus	18	935	189.00	18	955	165.10	18	1,119	134.75
Galloway	2	69	128.05	3	136	84.50	3	123	139.05
Polled Durham	2	79	129.45	6	244	124.50	3	106	130.35
Red Poll	3	35	97.80	1	3	50.00	3	97	83.00

[6] No public sales reported.

do if it "breeds true." It obviously could not be expected to breed true if at frequent intervals it were crossed with other types. The breeding of individuals all of the same general type, and belonging to a few family lines, could be safely left to the individual breeder in the earlier days of the industry. With the wider development of the industry this was no longer possible. It became necessary to have an official registration of pedigrees, which should be beyond any chance of manipulation by the breeder. In this way one wishing to purchase an animal of a particular breed would have definite and objective evidence that the individual was, in fact, of the breed it was supposed to be.

Out of this need have grown the systems of pedigree registration in herd-books, stud-books and the like. In certain countries at the present time these registry records have an enhanced official status, because they are under governmental control and supervision. In the United States the control of live-stock registration is in some degree supervised by the Bureau of Animal Industry of the federal Department of Agriculture, particularly so far as concerns the registration of imported animals.

Under this system of pedigree registration an animal is regarded as "pure bred" if both its sire and dam are recorded in one of the officially recognized books of registration. No further biological criterion is demanded. A strict biological interpretation of the words "pure bred" would exclude many animals which are registered under the present system. The biological conception of hereditary "purity" has become much refined in recent years, and it now appears that the term "pure bred" should apply in a strict sense to characters rather than to individuals.

The statistical data given in the foregoing discussion are by no means complete, but they serve sufficiently well the present purpose, which is simply to give some conception of the magnitude of the live stock breeding industry and its importance as a source of wealth to the nation. No account has been taken of other than farm live stock, and such obviously represents only a part of the animals which somebody has to breed to supply the needs of the people. Further nothing has been said about poultry, which represents an important industry in itself. Altogether, however, the following statement by Heape,[7] in concluding a review of the value of the breeding industry in England, is as well justified by conditions in this country, as in the country for which it was written. He says:

> All I have attempted is, to give such a broad idea of the number and value of live stock in the kingdom, as the careful consideration of evidence I have been able to obtain, permits. I have taken the utmost care to avoid exaggeration, and in this, at any rate, I have reason to think I have succeeded.
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> When it is recollected that the Board of Agriculture returns are below, may be 10 per cent. or even more below the correct figures; when it is recollected what a large proportion of the people in the country, farmers, dealers, shopkeepers, farm-labourers, working men of various kinds, and gentlemen's servants, make their living in one way or another by means of stock; when it is recollected what a very large number of valuable animals there are in this country, as shown by a sale of yearlings at Newmarket, the prices obtained at the dispersal of a herd of Shorthorns or a flock of Southdowns, the value of a successful horse on the turf, of a good hunter, polo pony, pair of carriage-horses or cart-horses, of a couple of pointers, a spaniel, a bull-dog or lap-dog, etc., when such facts are borne in mind I do not think there can be found justification for objection to the final figures I have arrived at on the score of excess; and yet they show a total sum of nearly £450,000,000 invested in live stock in this country.
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> When to this is added the capital necessary to provide both buildings to house the stock, land on which to grow their food, barns, machinery, vehicles, harness and attendance, the total becomes so gigantic that I am surely justified in asserting: We have here an industry of enormous importance to the country, and one which merits far more attention than has ever yet been accorded to it; an industry to which, it must be remembered, "Science has never yet been applied."

[7] Heape, W., "The Breeding Industry," Cambridge, 1906.